CLAIMS

1. A reaction vessel comprising:

a reaction vessel main body equipped with a reaction chamber having an opening and capable of holding a reaction solution; and

a cover member capable of sealing the opening of the reaction chamber;

wherein the cover member and the reaction chamber have a contact surface that comes into contact with the reaction solution held in the reaction chamber in a state in which the cover member is mounted on the reaction vessel main body, and

the cover member is made of a light transmitting material so that light can pass from the reaction solution held in the reaction chamber, through the contact surface of the cover member, to the outside of the reaction vessel, or the reaction vessel main body is made of a light transmitting material so that light can pass from the reaction solution held in the reaction chamber, through the contact surface of the reaction chamber, to the outside of the reaction vessel.

2. The reaction vessel according to Claim 1, wherein the cover member is made of a light transmitting material so that light can pass from the outside of the reaction vessel, through the contact surface of the cover member, to the reaction solution held in the reaction chamber, or the reaction vessel main body is made of a light transmitting material so that light can pass from the outside of the reaction vessel, through the contact surface of the reaction chamber, to the reaction solution held in the reaction chamber.

3. The reaction vessel according to Claim 1 or 2, wherein all or part of the contact surface of the cover member is flat.

4. The reaction vessel according to Claim 1 or 2, wherein the contact surface of the cover member is the surface of the wall component of substantially uniform thickness that constitutes the cover member.

5. The reaction vessel according to Claim 1 or 2, wherein all or part of the contact surface of the reaction chamber is flat.

6. The reaction vessel according to Claim 1 or 2, wherein the contact surface of the reaction chamber is the surface of the wall component of substantially uniform thickness that constitutes the reaction vessel main body.

7. The reaction vessel according to Claim 1 or 2, wherein a tightly closed space is formed by the contact surface of the reaction chamber and the contact surface of the cover member when the cover member is mounted on the reaction vessel main body, and all or part of the reaction solution is held in the tightly closed space.

8. The reaction vessel according to Claim 7, wherein a surplus reaction solution holder capable of holding any surplus reaction solution that cannot be held in the tightly closed space is formed in the reaction chamber when the cover member is mounted on the reaction vessel main body.

9. The reaction vessel according to Claim 1 or 2, wherein the reaction chamber has an opposing surface opposite the contact surface of the cover member, and when the cover member is mounted on the reaction vessel main body, all or part of the reaction solution held in the reaction chamber is held in the form of a thin layer between the

contact surface of the cover member and the opposing surface of the reaction chamber.

10. The reaction vessel according to Claim 9, wherein the opposing surface of the reaction chamber is the surface of the wall component of substantially uniform thickness that constitutes the reaction vessel main body.

11. The reaction vessel according to Claim 10, wherein the wall component having the opposing surface of the reaction chamber is made of a light transmitting material so that light can pass from the outside of the reaction vessel to the reaction solution held in the reaction chamber, and/or from the reaction solution held in the reaction chamber to the outside of the reaction vessel, through the opposing surface of the reaction chamber.

12. The reaction vessel according to Claim 9, wherein the reaction vessel main body has an abutting surface that defines the distance between the contact surface of the cover member and the opposing surface of the reaction chamber by abutting against the cover member.

13. The reaction vessel according to Claim 9, wherein the reaction chamber has an enveloping surface that envelops the reaction solution present between the contact surface of the cover member and the opposing surface of the reaction chamber, and

when the cover member is mounted on the reaction vessel main body, a tightly closed space is formed by the contact surface of the cover member, the opposing surface of the reaction chamber, and the enveloping surface of the reaction chamber, and all or part of the reaction solution is held in the form of a thin layer within the tightly closed space.

14. The reaction vessel according to Claim 13, wherein all or part of the enveloping surface of the reaction chamber is flat.

15. The reaction vessel according to Claim 14, wherein a lateral cross section of the enveloping surface of the reaction chamber is quadrangular.

16. The reaction vessel according to Claim 13, wherein the enveloping surface of the reaction chamber is the surface of the wall component of substantially uniform thickness that constitutes the reaction vessel main body.

17. The reaction vessel according to Claim 16, wherein the wall component having the enveloping surface of the reaction chamber is made of a light transmitting material so that light can pass from the outside of the reaction vessel to the reaction solution held in the reaction chamber, and/or from the reaction solution held in the reaction chamber to the outside of the reaction vessel, through the enveloping surface of the reaction chamber.

18. The reaction vessel according to Claim 7, wherein a nozzle tip fitting space, into which a nozzle tip mounted on a nozzle capable of the intake and discharge of a liquid can be fitted, is formed in the cover member, and a nozzle tip fitting hole leading to the nozzle tip fitting space is formed so as to allow the nozzle tip to be fitted into the nozzle tip fitting space while the cover member is mounted on the reaction vessel main body; and

a through-hole communicating between the outside of the reaction vessel, the tightly closed space, and the nozzle tip fitting space can be formed in the reaction vessel main body and the cover member by a puncture needle provided on the outside of the reaction vessel while the cover member is mounted on the reaction vessel main body.

19. The reaction vessel according to Claim 13, wherein a nozzle tip fitting space, into which a nozzle tip mounted on a nozzle capable of the intake and discharge of a liquid can be fitted, is formed in the cover member, and a nozzle tip fitting hole leading to the nozzle tip fitting space is formed so as to allow the nozzle tip to be fitted into the nozzle tip fitting space while the cover member is mounted on the reaction vessel main body; and

a through-hole communicating between the outside of the reaction vessel, the tightly closed space, and the nozzle tip fitting space can be formed in the reaction vessel main body and the cover member by a puncture needle provided on the outside of the reaction vessel while the cover member is mounted on the reaction vessel main body.

20. The reaction vessel according to Claim 18 or 19, wherein the nozzle tip fitting space is formed so that the nozzle tip fitting space is closed off when the nozzle tip fitting hole is sealed.

21. The reaction vessel according to Claim 20, wherein the wall component of the cover member forming the nozzle tip fitting space has an inner peripheral surface capable of

fitting snugly against the outer peripheral surface of the nozzle tip.

22. The reaction vessel according to Claim 21, wherein a convex component and/or a concave component capable of fitting with a concave component and/or a convex component provided on the outer peripheral surface of the nozzle tip is provided on the inner peripheral surface of the wall component of the cover member capable of snugly fitting against the outer peripheral surface of the nozzle tip.

23. The reaction vessel according to Claim 18 or 19, wherein the contact surface of the cover member is the surface of the wall component of the cover member forming the nozzle tip fitting space.

24. The reaction vessel according to Claim 18 or 19, wherein the contact surface of the cover member is the surface of the wall component of the cover member forming the deepest portion of the nozzle tip fitting space.

25. The reaction vessel according to Claim 24, wherein the wall component of the cover member forming the deepest portion of the nozzle tip fitting space is provided so as to

oppose the wall component of the reaction vessel main body forming the deepest part of the tightly closed space.

26. The reaction vessel according to Claim 18 or 19, wherein the nozzle tip fitting space is formed such that the mounting direction of the nozzle tip with respect to the nozzle tip fitting space is perpendicular or substantially perpendicular to the surface on which the reaction vessel is placed.

27. The reaction vessel according to Claim 18 or 19, wherein the cover member has an outer peripheral surface capable of fitting snugly against the inner peripheral surface of the reaction chamber.

28. The reaction vessel according to Claim 27, wherein a concave component and/or a convex component is provided on the inner peripheral surface of the reaction chamber, and

a convex component and/or a concave component capable of mating with the concave component and/or the convex component provided on the inner peripheral surface of the reaction chamber is provided on the outer peripheral surface of the cover member.

29. The reaction vessel according to Claim 1 or 2, being a reaction vessel for PCR.

30. A reaction apparatus, comprising the reaction vessel according to Claim 2, a temperature controller, a light source, and a fluorescent light detector,

wherein the temperature controller is attached to the cover member and/or the reaction vessel main body so that temperature of the reaction solution held in the reaction chamber can be controlled through the contact surface of the cover member and/or the contact surface of the reaction chamber,

the light source is provided so that the reaction solution held in the reaction chamber can be irradiated with light through the contact surface of the cover member and/or the contact surface of the reaction chamber, and

the fluorescent light detector is provided so that fluorescent light emitted from the reaction solution held in the reaction chamber can be detected through the contact surface of the cover member and/or the contact surface of the reaction chamber.

31. The reaction apparatus according to Claim 30, wherein the temperature controller is attached to the wall

component of substantially uniform thickness that constitutes the cover member and that has the contact surface of the cover member, and/or the wall component of substantially uniform thickness that constitutes the reaction vessel main body and that has the contact surface of the reaction chamber.

32. The reaction apparatus according to Claim 30, wherein the reaction vessel is the reaction vessel according to Claim 13,

the temperature controller is attached to the cover member and/or the reaction vessel main body so that temperature of the reaction solution held in the reaction chamber can be controlled through the contact surface of the cover member and/or the opposing surface of the reaction chamber,

the light source is provided so that the reaction solution held in the reaction chamber can be irradiated with light through the enveloping surface of the reaction chamber, and

the fluorescent light detector is provided so that fluorescent light emitted from the reaction solution held in the reaction chamber can be detected through the enveloping surface of the reaction chamber.

33. The reaction apparatus according to Claim 32, wherein the temperature controller is attached to the wall component of substantially uniform thickness that constitutes the cover member and that has the contact surface of the cover member, and/or the wall component of substantially uniform thickness that constitutes the reaction vessel main body and that has the opposing surface of the reaction chamber.

34. The reaction apparatus according to Claim 32, further comprising a plurality of optical fibers disposed around the enveloping surface of the reaction chamber,

wherein the irradiation of the reaction solution with light from the light source and/or the detection of fluorescent light emitted from the reaction solution is accomplished by utilizing the optical fibers.

35. A reaction apparatus, comprising a reaction vessel installation part in which the reaction vessel according to Claim 18 or 19 is installed, a first temperature controller, a second temperature controller, a light source, and a fluorescent light detector,

wherein the first temperature controller is provided so that the temperature of the reaction solution held in the tightly closed space of the reaction vessel installed in the reaction vessel installation part can be controlled through the contact surface of the reaction chamber,

the second temperature controller is removably mounted in the nozzle tip fitting space of the cover member and provided so that the temperature of the reaction solution held in the tightly closed space of the reaction vessel installed in the reaction vessel installation part can be controlled through the contact surface of the cover member,

the light source is provided so that the reaction solution held in the tightly closed space of the reaction vessel installed in the reaction vessel installation part can be irradiated with light through the contact surface of the cover member and/or the contact surface of the reaction chamber, and

the fluorescent light detector is provided so that fluorescent light emitted from the reaction solution held in the tightly closed space of the reaction vessel installed in the reaction vessel installation part can be detected through the contact surface of the cover member and/or the contact surface of the reaction chamber.

36. The reaction apparatus according to Claim 35, wherein the reaction vessel is the reaction vessel according to Claim 19,

the first temperature controller is provided so that the temperature of the reaction solution held in the tightly closed space of the reaction vessel installed in the reaction vessel installation part can be controlled through the opposing surface of the reaction chamber,

the light source is provided so that the reaction solution held in the tightly closed space of the reaction vessel installed in the reaction vessel installation part can be irradiated with light through the enveloping surface of the reaction chamber, and

the fluorescent light detector is provided so that fluorescent light emitted from the reaction solution held in the tightly closed space of the reaction vessel installed in the reaction vessel installation part can be detected through the enveloping surface of the reaction chamber.

37. The reaction apparatus according to Claim 36, further comprising a plurality of optical fibers disposed around the enveloping surface of the reaction chamber,

wherein the irradiation of the reaction solution with light from the light source and/or the detection of

fluorescent light emitted from the reaction solution is accomplished by utilizing the optical fibers.

38. The reaction apparatus according to Claim 35, further comprising a temperature controller mounting and removing part for mounting and removing the second temperature controller in the nozzle tip fitting space,

wherein the temperature controller mounting and removing part performs an operation for mounting the second temperature controller in the nozzle tip fitting space prior to the reaction, and operation for removing the second temperature controller from the nozzle tip fitting space after the reaction.

39. The reaction apparatus according to Claim 35, further comprising a puncture vessel installation part in which a puncture vessel is installed, a nozzle capable of the intake and discharge of a liquid, and a nozzle transfer part,

wherein the puncture vessel comprises a liquid holding space capable of holding a liquid, an opening that leads to the liquid holding space, and a puncture needle,

the liquid holding space is formed so that the reaction vessel can be accommodated in the liquid holding space through the opening,

the puncture needle is provided so as to protrude into the liquid holding space from the wall component of the puncture vessel forming the liquid holding space,

the nozzle transfer part performs an operation for fitting the nozzle tip mounted on the nozzle in the nozzle tip fitting space of the reaction vessel installed in the reaction vessel installation part, operation for transferring the reaction vessel with the mounted nozzle tip fitted thereinto to the puncture vessel installation part, and operation for accommodating the reaction vessel in the liquid holding space of the puncture vessel installed puncture vessel installation part, and for forming in the cover member and the reaction vessel main body, by means of the puncture needle provided in the puncture vessel, a through-hole that communicates with the nozzle tip fitting space, the tightly closed space of the reaction vessel, and the liquid holding space of the puncture vessel, and

the nozzle performs an operation for extracting the reaction solution held in the tightly closed space of the reaction vessel into the liquid held in the liquid holding

space of the puncture vessel, by the intake and discharge of the liquid through the through-hole.

40. The reaction apparatus according to Claim 30 or 35, being a reaction apparatus for PCR.

41. A method, comprising the steps of:

(a) bringing the reaction solution held in the reaction chamber into contact with a contact member;

(b) controlling the temperature of the reaction solution through the contact surface between the reaction solution and the reaction chamber and/or the contact surface between the reaction solution and the contact member;

(c) irradiating the reaction solution with light through the contact surface between the reaction solution and the reaction chamber and/or the contact surface between the reaction solution and the contact member; and

(d) detecting fluorescent light emitted from the reaction solution through the contact surface between the reaction solution and the reaction chamber and/or the contact surface between the reaction solution and the contact member.

42. The method according to Claim 41, wherein the contact surface of the reaction chamber utilized for controlling the temperature of the reaction solution is different from the contact surface of the reaction chamber utilized for irradiating the reaction solution with light and/or the contact surface of the reaction chamber utilized for detecting fluorescent light from the reaction solution.

43. The method according to Claim 41, wherein a nozzle tip fitting space, into which a nozzle tip mounted on a nozzle capable of the intake and discharge of a liquid can be fitted, is formed in the contact member, and further comprising the steps of:

(e) forming a through-hole that communicates with the outside of the reaction chamber, the inside of the reaction chamber, and the nozzle tip fitting space by means of a puncture needle provided to the outside of the reaction chamber after completion of a reaction in the reaction chamber;

(f) mounting the nozzle tip mounted to the nozzle in the nozzle tip fitting space;

(g) bringing the outside of the reaction chamber into contact with a liquid; and

(h) extracting the reaction solution held in the reaction chamber into the liquid by operating the nozzle and performing the intake and discharge of the liquid through the through-hole.

44. The method according to Claim 41, wherein the reaction occurring in the reaction chamber is a PCR.